

S
333.70285
N11r
1996

STATE DOCUMENTS COLLECTION

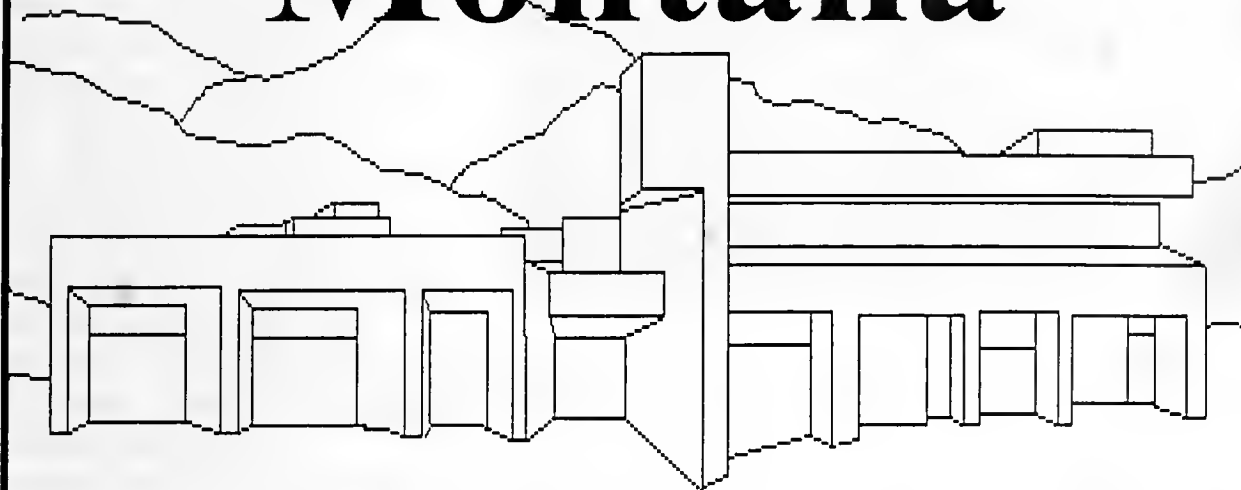
FEB - 5 1997

MONTANA STATE LIBRARY

3 0864 0014 4659 3

MONTANA STATE LIBRARY
1515 E. 6th Ave.
HELENA, MONTANA 59601

Montana



Natural Resource Information System

Fiscal Year 1996 Annual Report

PLEASE RETURN

Montana

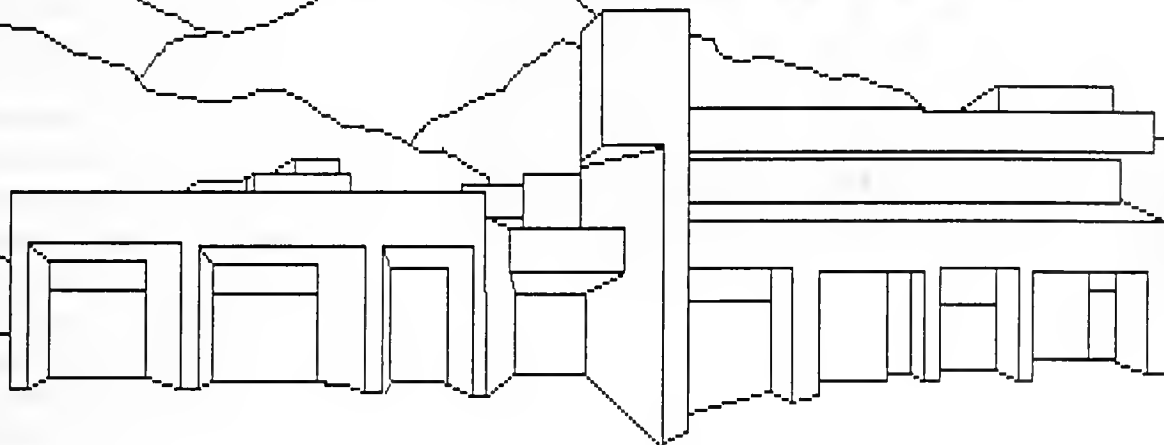


NRIS

FEB - 5 1997

MONTANA STATE LIBRARY
1515 E. 6TH AV.
HELENA, MONTANA 59624

Montana



Natural Resource Information System

Fiscal Year 1996 Annual Report

PLEASE RETURN

Montana



NRIS

Introduction

The Montana Natural Resource Information System (NRIS) was formed in response to the growing need for quick access to the increasing amounts of natural resource information.

As a program of the Montana State Library, NRIS works to make information on

Montana's natural resources easily and readily accessible. Serving government agencies, business and industry, and private citizens, NRIS operates a clearinghouse and

referral service to link users with the best information. In 1985, NRIS began by providing services through its Montana Natural Resource Index and the Montana Natural Heritage Program. In response to growing user needs, the program expanded to include the Montana Water Information System and the NRIS Geographic Information System.

Over the years, NRIS strived to meet the growing information needs and challenges of Montana's governmental agencies, private business, and general public by developing new services. NRIS now offers a wide variety of data management, information indexing, and data retrieval services.

Fiscal year 1996 was a busy time for NRIS. We filled over 2,180 requests for natural resource information and services. The **Natural Heritage Program** responded to over 750 requests; the **Water Information System** responded to over 560 information requests; and the **Geographic Information System** responded to over 860 service and information requests.

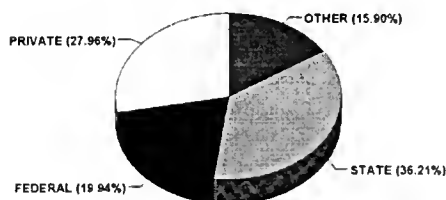
NRIS Mission Statement

The Montana Natural Resource Information System provides comprehensive access to information about Montana's natural resources to all Montanans through the acquisition, storage, retrieval, and dissemination of that information in meaningful form.

Natural Resource Information System Users by Sector

Natural Heritage Program, Water Information System,
Geographic Information System

Number of Requests 2,182



FY96 Highlights

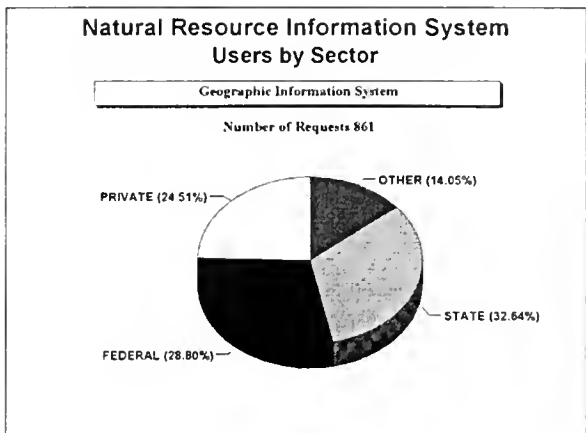
Detailed reports for each of the NRIS programs are contained in the following pages. This section provides a quick overview of some of the program's activities during FY96.

Geographic Information System

During FY96, the NRIS GIS program continued providing a diverse array of products and services to Montana's GIS community. Some services were the traditional mediated services where we assist GIS users on an individual basis. Some services were new networked based services where we publish information on the Internet that patrons can access themselves.

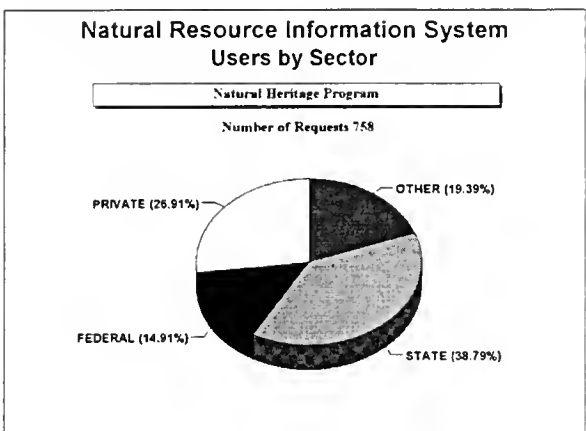
As GIS technology matures and becomes more integrated into organizations, the demand for analytical applications has been increasing. As one of the leaders in the use of GIS technology in Montana, NRIS GIS is asked frequently to assist in developing major GIS analytical applications. This year, we undertook three major analytical projects: two for the US Forest Service and one for the Department of Health and Environmental Sciences. These projects are detailed under the *Projects Overview* section of this report.

With the maturing of our Internet services during FY95, the way NRIS GIS conducts business is fundamentally changing. We now have an increased ability to invest time and resources in building an information infrastructure that permits us to publish data and information that can and is accessed by many users. After we publish data and information on the Internet our patrons can access the information at their convenience without impacting NRIS GIS staff. This allows us to meet the needs of a much larger community and frees up resources to provide a higher level of service to those who need it.



Natural Heritage Program

Refining access to and delivery of program information remained a priority in 1996. A pilot project between The Nature Conservancy and the National Biological Service helped us develop new features on the Internet including: an on-line request form; better graphics capabilities; data searches based on county or species status; and a prototype sensitive species guidebook. Results of this project will be applied in other states as their data management and Internet capabilities allow. Linkages with GIS and development of new databases and systems, described below, have continued to allow us to stay abreast with the rising demands for information on biodiversity and land



management.

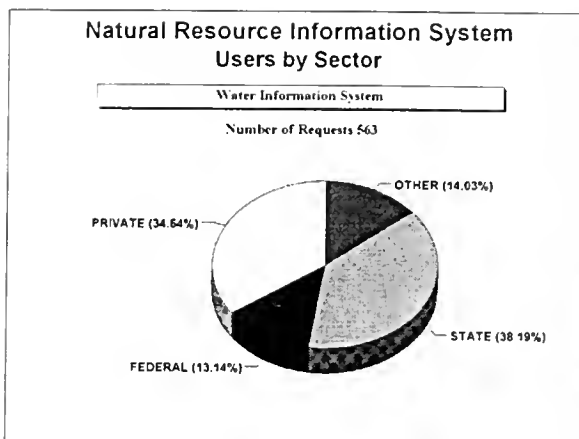
The Heritage Program conducted significant research and inventory projects during the year, incorporated the results of these projects into its database system, and continued to provide information services to state and federal agencies, county and local offices, private consulting firms and academic and foreign requestors.

Approximately 1,500 data requests were received and answered in FY 1996, from all sectors: state, federal, local government as well as the private sector. This figure includes requests placed by U.S. Forest Service staff in Region 1 via a subset of Heritage data available on their mainframe system. These figures do not include visits to our Internet site, which numbered over 13,000.

Water Information System

During 1996, staff continued improving access to water data by increasing the number of Internet links to new and existing sources of water information. Also during this time, many of the data sources established new products and report formats on the Internet. These new products make water information easier to obtain and interpret. Together with the Water Information System's efforts, these new products represent major strides that improve service to end users by making it easier to obtain information in ready-to-use formats. Many more users are taking advantage of the improved service, a fact demonstrated by the dramatic increase in the number of users obtaining water data directly via the Internet during the reporting period.

The Water Information System continues to use geographic information system (GIS) and new relational data base technologies increasingly to serve System users by developing tools for a variety of water related applications. This year staff assisted personnel from several other state agencies in obtaining and applying the GIS as an effective desktop tool for well head protection and management of solid waste landfill sites. Significant progress was also achieved in using new relational data base software to develop data bases with user interface menus that support traditional information management applications both within NRIS and other state natural resource agencies.



NRIS On the Internet: <http://nris.mt.gov>



Natural Resource Information System

Montana

Water Information

Heritage Information

Geographic Information



During FY96 NRIS continued to expand our Internet presence. NRIS operates a File Transfer Protocol (FTP) server, electronic mail services for all of the NRIS staff and the State Library, a Telnet server that allows remote log in to the NRIS network, and our most visible service--our World Wide Web (WWW) site. The WWW site consists of a "Home Page" that describes the overall program and provides hyper links to other pages that provide details on all of NRIS's services and as well as access to natural resource data. The NRIS site is an on-line clearinghouse of natural resource information with connections to a myriad of other related sites around the

nation. During FY96, there were an average of over 1,800 user sessions per week on the NRIS Web site.

NRIS also greatly expanded the GIS Wide Area Information Service (WAIS) server.

The GIS WAIS Server allows a remote patron to search our GIS database for data,

retrieve information documenting the data, view a sample of the data on-line, and then retrieve the data directly to their computer. During FY96 we completed a grant NRIS received from the Federal Geographic Data Committee. The grant was to create a Montana node of the National Spatial Data Infrastructure (NSDI). The NSDI includes a clearinghouse for locating and obtaining spatial data. Montana was the first state in the nation to implement a NSDI node.



National Spatial Data Infrastructure
National Geospatial Data Clearinghouse
Montana State Library Node

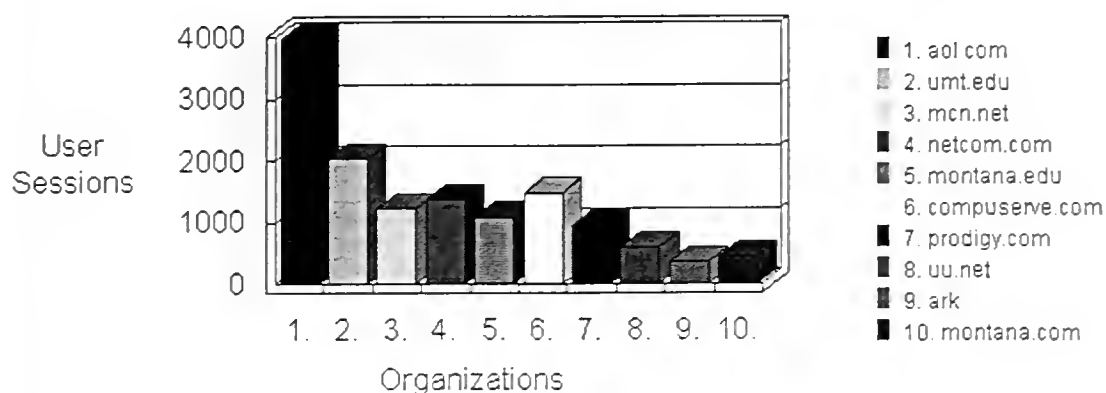
Below are some figures and charts that demonstrate the extent the NRIS WWW services are accessed.

Basic Access Statistics

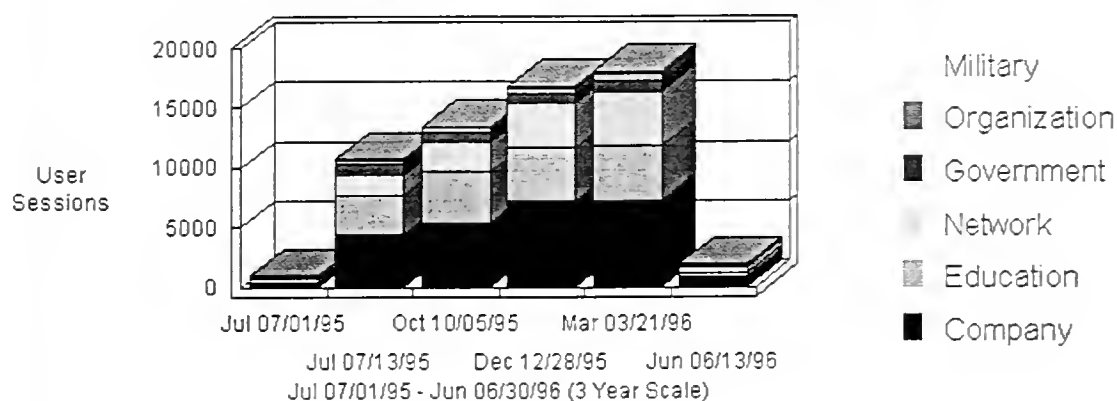
July 1, 1995 to June 30, 1996

Number of Hits for home page	24,301
Total No. of Successful Hits	1,275,363
Total No. of User Sessions	95,621
User Sessions from (United States)	65.56%
International User Sessions	6.12%
Origin Unknown User Sessions	28.31%
Average User Sessions per Day	261

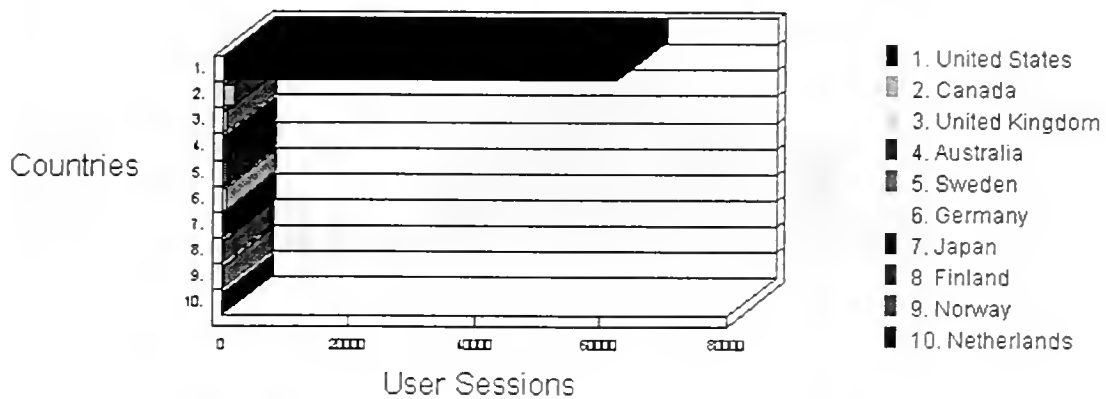
Most Active Organizations



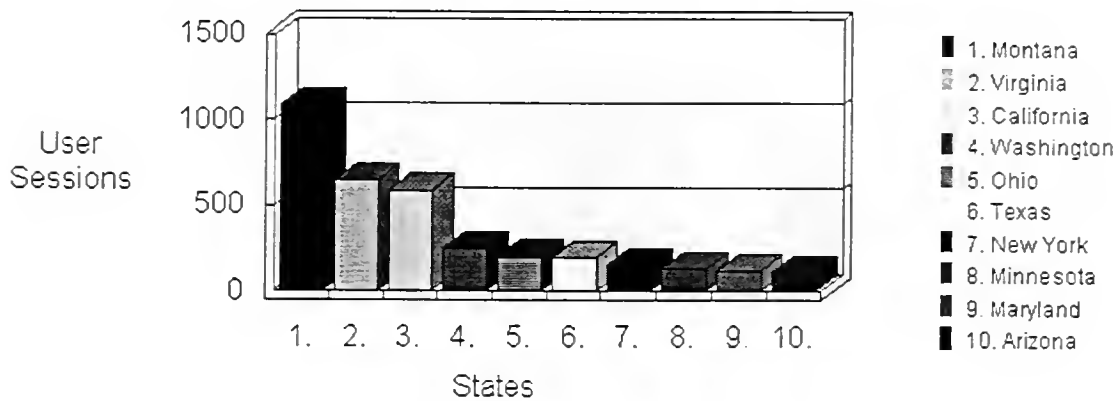
Organization Breakdown



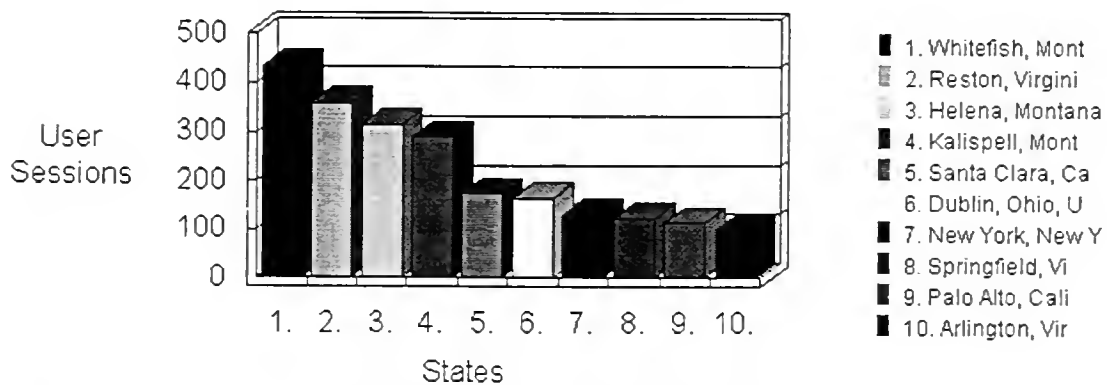
Most Active Countries



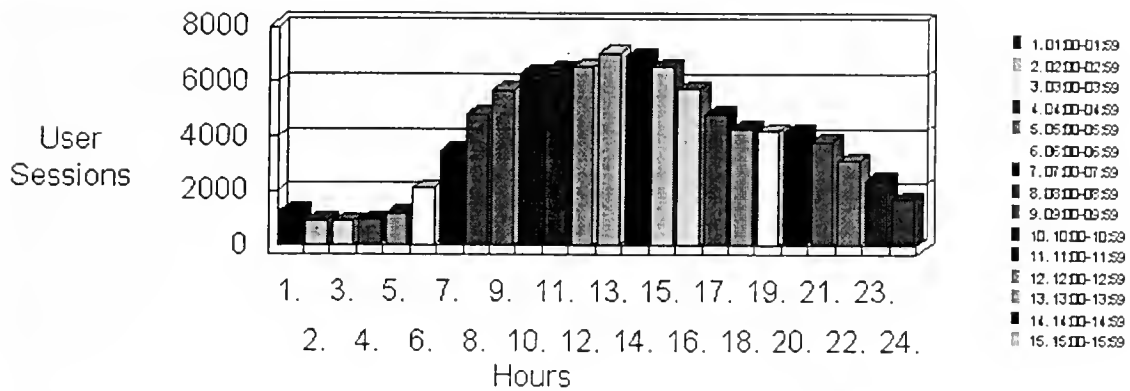
North American States & Provinces



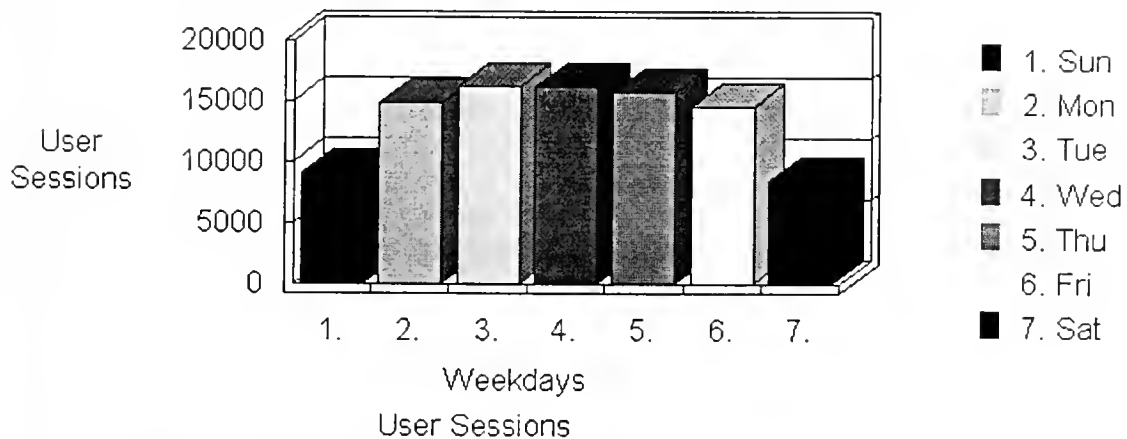
Most Active Cities



Activity By Hour of Day



Activity By Day of Week



Geographic Information System

During FY96, the NRIS GIS program continued providing a diverse array of products and services to Montana's GIS community. Some services were the traditional mediated services where we assist GIS users on an individual basis. Some services were new networked based services where we publish information on the Internet that patrons can access themselves.

As GIS technology matures and becomes more integrated into organizations, the demand for analytical applications has been increasing. As one of the leaders in the use of GIS technology in Montana, NRIS GIS is asked frequently to assist in developing major GIS analytical applications. This year, we undertook three major analytical projects: two for the US Forest Service and one for the Department of Health and Environmental Sciences. These projects are detailed under the *Projects Overview* section of this report.

With the maturing of our Internet services during FY95, the way NRIS GIS conducts business is fundamentally changing. We now have an increased ability to invest time and resources in building an information infrastructure that permits us to publish data and information that can and is accessed by many users. After we publish data and information on the Internet our patrons can access the information at their convenience without impacting NRIS GIS staff. This allows us to meet the needs of a much larger community and frees up resources to provide a higher level of service to those who need it.

During FY96 we filled 897 total requests and developed 9526 products through our mediated services. This number represents a significant increase in total requests for mediated services over FY95. We also provided information through the Internet to an additional 55, 446 patrons. Hundreds of thousands of maps, documentation reports, and databases were acquired from our Internet servers. We intend to continue to enhance our Internet services during the upcoming year to provide our patrons with easy, efficient, methods to identify and acquire the information they need.

The tables below summarize GIS products and services provided during the last two fiscal years.

FY 1996 Mediated GIS Services Summary

Total Requests	Maps	Reports	Programs	Data	Other	Total Products
897	5409	201	53	2449	229	8341

FY 1995 Mediated GIS Services Summary

Total Requests	Maps	Reports	Programs	Data	Other	Total Products
466	4502	45	33	1065	158	5803

Internet Services

Use of Internet services provided by NRIS GIS exploded during FY95. Currently patrons who are on the Internet can access the GIS program to find general information or to access selected map graphics, documentation, and databases. These services have been implemented by installing a World Wide Web (WWW) server and "Home Page", a Wide Area Information Server (WAIS), and an "Anonymous FTP" site on the GIS computer network. Use of the Internet services has grown steadily since their inception. During FY 1996 39,316 users accessed NRIS GIS web services, this represents a 58% increase over 1995 when we had 22,919

We started collecting statistics on Internet usage in August of 1994 and since then there have been 22,919 accesses of the GIS Web Services. Currently over 500 users access GIS services from NRIS in an average week. Plans call for expanding the number of databases on the Internet servers and developing new interfaces and indices to facilitate access.

Montana GIS Users' Group

NRIS GIS plays an active role in the Montana GIS Users' Group. The Users' Group is a non-profit consortium of government agencies and business involved with GIS technology. The main activities of the Users' Group are an annual conference and publication of the *Montana GIS News*. The *Montana GIS News* is designed to facilitate the transfer of information about GIS data, activities, and projects in Montana. The newsletter is published by NRIS for the Montana GIS Users' Group.

The annual Montana GIS Users' Group Conference provides an opportunity for individuals interested in GIS to share ideas and experiences. The 1995 Conference in Helena attracted over 300 people. NRIS helped with the conference by providing administrative support, actively participating on planning committees, hosting workshops, and making presentations. NRIS also hosted a Public Night where members of the local community had an opportunity to learn about GIS.

A major effort undertaken by the Users' Group this year is the establishment of endowed scholarships at both major Montana Universities. The scholarships will assist students pursuing studies related to GIS. The goal is to have a \$10,000 endowment at Montana State University by 1997 and at the University of Montana by the year 2000. The endowments should provide \$500 per year in perpetuity. Fred Gifford and Kris Larson both serve on the GIS Users' Group Board of Directors.

Montana Interagency GIS Technical Working Group

The Montana Interagency GIS Technical Working Group (TWG) is a forum for the exchange of information regarding the acquisition of new GIS data, the existence of current GIS data, and the status of new and on going GIS projects. The TWG also promotes and develops standards and procedures related to GIS. NRIS supports the TWG by providing administrative support and by actively participating in meetings and sub-committees. Major activities for the TWG during FY 1995 were associated with implementing a grant from the Federal Geographic Data Committee (FGDC). The grant was to promote use of the Internet for data sharing and cooperation among GIS users in Montana. NRIS was the lead agency responsible for the grant implementation. Tasks completed included:

Develop Implementation Plan - The implementation plan is the guiding document directing efforts in pursuit of the goals approved by the TWG. The plan included tasks to be performed under this grant and tasks to be accomplished outside the grant project.

Update and Enhance the Montana GIS Data Directory - The *Montana Data Directory* is PC-based application that allows users to query information about GIS data and projects in Montana. Under the grant we evaluated converting existing *Montana GIS Data Directory* entries to meet the FGDC Metadata Standard but found it unworkable. We then decided to survey the GIS user community about their GIS holdings. This information is being converted into a format accessible on a WAIS server and can be accessed via the Internet.

Implement One Node on the FGDC Clearinghouse - A WAIS server with documentation about NRIS GIS databases was implemented on the existing NRIS system. Since the major infrastructure was already in place, the primary work required under this task was installing and configuring the WAIS software and converting the existing documentation to the correct structure. We also placed some high-interest GIS databases on the WAIS server.

Develop Tools for Documenting Data to the FGDC Metadata Standard - NRIS GIS developed software tools for documenting data to the FGDC standard. This interface is implemented in Arc/Info. NRIS uses this tool for documenting all its' GIS holdings. The software will also be made available to any other sites interested in using it to document their own databases.

Research and Identify Tools for Searching for Spatial Data on the Internet - There are many tools available for searching the Internet and new tools are continually developed. We have identified as many of these tools as possible so that we may provide them or information about them to GIS users in Montana.

Update the Montana GIS Standards Plan to Comply with FGDC Metadata Standard and the Spatial Data Transfer Standard - The *Montana GIS Standards Plan* was developed by the TWG to facilitate data exchange among agencies by ensuring consistency in the development and documentation of GIS data bases. Topics covered in the *Plan* include: source materials, data automation, accuracy, documentation, and data transfer methods. Under the grant, the *Montana GIS Standards Plan* was revised to adhere to the FGDC Metadata Standard and the Spatial Data Transfer Standard.

Implement a Montana GIS Users List Server on the Internet - List servers allow Internet users to send an e-mail message to one address and have it broadcast to many others interested in that topic. The University of Montana implemented the Montana GIS List Server to facilitate communication among the Montana GIS community.

GIS Seminars

For the past five years, the NRIS GIS Program has offered a series of GIS Seminars. The seminars are held once a month throughout the fall, winter, and spring. A GIS expert typically gives an hour long presentation to a wide variety of GIS users from governmental agencies and the private sector. The topics of the seminars range from software specific technical tips and tricks to general information about topics such as cartography or new GIS projects in the state. At the request of the GIS Users' Group, NRIS also sponsored a half-day workshop in 1995, *Understanding and Using Map Projections*, by Gerry Daumiller. Other Seminar Topics for the

1994-95 season included: *Montana's Public Lands and Private Preserves - On the Ground and in the Computer* by Cedron Jones; *Surfing the Internet for Fun and Profit* by Fred Gifford; *The Milk River Existing Irrigation and Water Rights Evaluation* by Bill Greiman; *Wildlife Distribution Mapping by Fish, Wildlife and Parks: How Far Are We, Where Do We Go From Here* by Gael Bissell; *An Update on the Status of the National Spatial Data Infrastructure* by Allan Cox; and *GIS-GPS and Archaeology - A Pioneering Montana Project* by Peter Langen and Mark Baumler.

GIS in Libraries

Several new libraries joined the "GIS in Libraries" program in 1995 and we are sponsoring new schools in the "K-12 GIS Program " as well. The libraries and schools participating in the project now include: Dennis Richards at the Mansfield Library in Missoula; Cynthia Rooley at the Liberty County Library; Tim Urbanic at the Billings Vo-Tech Library; Bill Mc Gregor at the Citizens Technical Environmental Committee in Butte; Alice Hallstrom, Hot Springs Library; Nancy Brennan, Bicentennial Public Library, Colstrip; Michael Ober at the Flathead Valley Community College; Dennis Brown at Capital High School in Helena; Margy Kernan at Helena High; T.A. Hennard, Corvallis High School; Norma Glock at Columbus High School Library; John Meckler at the Plains High School; Arlie Patton at Billings West High School; Chris Ruffatto at Whitfish High School; Jon Kaps, Flathead High School Library; and Gil and Marilyn Alexander at Canyon Ferry Limnological Institute. The Montana State Library is also one of the more than 100 participants nationwide in the Association of research Libraries "GIS in Libraries" project.

Training procedures have been working well. Training is offered on-site as the school or library comes on-line. If several libraries come up at the same time, then training may be offered at the Montana State Library.

Pam Smith has been working on a "GIS in Schools and Libraries" section for the Library homepage, NRIS homepage, and GIS homepage. It will include pointers to some of the more exciting data sources, such as the ESRI FTP site and the Bessie project; pointers to our data; Guidelines for becoming part of the "GIS in Libraries" or K-12 Programs; a pointer to the ArcView software and a *unix2dos* software utility. We will also provide information to explain the difference between ArcView and ArcView2.

The 1995 Montana GIS Users' Conference was held in Helena, May 8 - 10. The GIS Users' Group hosted the Fourth Annual Public Night in conjunction with the conference. As always, poster presenters and vendors were available to show their work, share ideas, and answer questions. Allan Cox gave the annual presentation which explains GIS in lay terms, and described some of the GIS projects affecting the state, and computers were available for the public to see and use. But for the first time, we invited local schools to participate. There were special demonstrations, computers, and mini-workshops set up for the K-12 crowd. About 30 students participated in the event.

In the fall of 1994, the unix workstation in the reference section of the state Library was replaced with a PC to help make user access easier. Particularly, with the release of ArcView 2, the PC was not powerful enough to view and use the data accessed by ArcView in a reasonable time frame. MSL now has a more powerful laptop PC with a permanent port into the MSL network.

Projects Overview

Department of Health and Environmental Sciences - Clark Fork Superfund Project: The Clark Fork GIS (CFGIS) continues to be the largest project for NRIS GIS. The system, in place since 1988, is at full maturity. Traditionally, map products have been the primary product produced by the CFGIS. This trend continued during FY95 with 2,766 maps delivered. As the system develops and more analytical data are made available by the Clark Fork Data Management System (CFDMS), the GIS has been used for more analytical uses. Some example analytical tasks completed this year include:

Create map depicting groundwater quality using Stiff diagrams. Import groundwater quality data for Milltown area. Run AML program for producing Stiff diagrams. Design map depicting Stiff diagrams and miscellaneous basemap features.

Calculate volume of tailings for buffer around Silver Bow Creek. Map areas where tailings are less than two feet above ground water and where tailings are more than two feet deep, where tailings are less than two feet deep, 100 year floodplain, haul roads, and tailings repositories. Figure volume of tailings greater than and less than two feet deep within 50 feet of Silver Bow Creek. Figure volume of tailings that are more than two feet below the ground. Figure volume of tailings more than two feet below the ground where tailings are more that two feet above the ground water.

State Historic Preservation Office: GIS staff worked with the State Historic Preservation Office (SHPO) to develop a database for a major project they have on the Flying D ranch in southwestern Montana. The project tasks completed this year included database development, map production, and analysis. Specific tasks included:

Development of ranch-wide 1:64,000 basemaps, and a 7.5 minute, 1:24,000 basemap series for the ten quad ranch area. These maps have been used for displaying site and IA data;

Importation of 7.5 minute Digital Elevation Model (DEM) data for nine of the ten quads covering the ranch area (DEM for Norris NE quad is not available). The data have been used in the construction of several contour coverages and in viewshed analysis;

Use of the 7.5 minute DEM in a solar radiation study for the Cherry Creek Canyon quad. A series of maps and graphs showing base data and solar radiation indices for various times of the year were created for the study;

Linkage of the SHPO SITES database and the SHPO SOURCE database to the GIS database. These linked databases have been used for the spacial analysis of artifact types, raw materials and source areas;

A total of seven days were spent in the field collecting GPS points and polygons for archaeological sites, artifacts and features, such as tipi rings. This year the GPS field work was fully integrated with the standard surveys conducted by the State Archaeologist.

U.S. Forest Service: The GIS program worked on several projects with the US Forest Service (USFS) during FY95. For the Helena National Forest, we assisted with revisions of an Environmental Impact Statement (EIS) for oil and gas development on the forest. The EIS required the combining of 50 GIS databases in different combinations to develop criteria for

evaluating seven development alternatives. NRIS GIS staff developed the GIS processing steps required to complete the EIS and designed and produced the maps used in the final report.

For Region 1 of the US FOREST Service, NRIS GIS provided technical support for the Columbia River Basin Assessment (CRB). The CRB project was in response to a directive from President Clinton to the USFS to develop an ecosystem based strategy for management of forests east of the Cascades in the interior Columbia River Basin.

NRIS GIS contracted with the US Forest Service to provide GIS consulting and analysis to support the CRB project. Work on this project included assimilating GIS databases, designing processing and analysis steps, and performing the processing to support watershed classification and modeling of the entire Columbia River drainage basin.

Because of the large geographic extent of the project area and the relatively large scale of the GIS databases being processed this project was a very large data processing task. Once the processing steps were finalized NRIS GIS staff spent eight weeks, running five UNIX workstations, 24 hours a day, seven days a week to complete the analysis.

Montana Department of Fish Wildlife and Parks: NRIS provided several services to FWP in FY95. Included were:

River Reach Database Development: - Under contract with the Fisheries Division NRIS completed development of a statewide Geographic Information System (GIS) river reach database. This database provides the vehicle for managing and analyzing environmental, natural resource, and management information associated with surface water features.

Major tasks undertaken as part of this project were: indexing the river reach database to the Montana Rivers Information System (MRIS) database; organizing a River Reach Technical Working Group to set directions for database development and pursue joint funding opportunities; and developing procedures for completing enhancements of the river reach database.

Technical Support: NRIS provided the Kalispell office assistance in using GIS software and hardware during the period. NRIS also provided access to its' electrostatic plotter for producing large color printouts of maps developed by FWP staff on their GIS system.

Department of State Lands: NRIS worked with two DSL bureaus during FY95. Projects included:

Coal and Uranium Bureau: During FY 1995, the GIS provided various services in support of the Department of State Lands (DSL) Coal and Uranium Bureau GIS. GIS staff continued to supply technical support to DSL GIS staff as requested. Technical tasks completed included assistance with loading new releases of GIS and UNIX operating system software. NRIS also provided administrative support and paid for the DSL UNIX and GIS software maintenance agreements.

Abandoned Mine Bureau: NRIS GIS staff developed programs and procedures to automate the development of 230 mining district maps. The maps were composed of US Geological Survey 1:100,000 scale basemap data, DSL mining district layer, and the NRIS US Forest Service ownership layer. GIS staff combined the data layers and hand placed annotation to

create the 230 individual maps. Hardcopy and electronic versions of the maps were delivered to DSL.

Natural Resource Damage Claim: NRIS GIS provided various GIS services under contract to the Natural Resource Damage Claim (NRDC) in the Montana Department of Justice during FY 1995. Tasks completed included map design, database development, and analysis. NRIS also supplied NRDC contractors with various databases for their use.

Department of Health and Environmental Sciences - Air Quality Division: NRIS GIS supported DHES staff with mapping and analysis of project areas in Whitefish, Billings, and East Helena. For the Whitefish area we acquired data from the Montana Department of Transportation and the US Census Bureau in order to develop reports and maps about traffic and population densities on a one kilometer grid. For the Billings and East Helena areas we developed basic maps for use in reports.

Natural Heritage Program

Refining access to and delivery of program information remained a priority in 1996. A pilot project between The Nature Conservancy and the National Biological Service helped us develop new features on the Internet including: an on-line request form; better graphics capabilities; data searches based on county or species status; and a prototype sensitive species guidebook. Results of this project will be applied in other states as their data management and Internet capabilities allow. Linkages with GIS and development of new databases and systems, described below, have continued to allow us to stay abreast with the rising demands for information on biodiversity and land management.

Data Management: Acquisition, storage, manipulation, and retrieval of information for project planning and research

The Heritage Program conducted significant research and inventory projects during the year, incorporated the results of these projects into its database system, and continued to provide information services to state and federal agencies, county and local offices, private consulting firms and academic and foreign requesters.

Approximately 1,500 data requests were received and answered in FY 1996, from all sectors: state, federal, local government as well as the private sector. This amount includes requests placed by U.S. Forest Service staff in Region 1 via a subset of Heritage data available on their mainframe system. These figures do not include visits to our Internet site, which numbered over 13,000.

Katherine Jurist assumed primary responsibility for handling data requests and response time continues to be under five days for all but the most complex requests. Information on sensitive species in the vicinity of planned projects or development was the most frequently-received type of request. A heavy user of the program was the Department of Natural Resources and Conservation: we regularly reviewed opencut mining applications and semi-annual oil and gas leasing areas. Periodic review of highway projects from the Montana Department of Transportation continued, with requests submitted by both MDT and consulting firms contracting

with MDT. Local weed cooperatives were also regular users of our system as required through the Department of Agriculture. We also handled requests that were referred to us by Montana Department of Fish, Wildlife and Parks.

Virtually all requests are now accompanied by a GIS map showing general locations of sensitive species as part of the data response. We can easily search large areas of the state, stream or highway corridors, or irregularly-shaped project areas, providing users with a graphic projection of locations in addition to the detailed information in text form.

The Internet has become a significant tool for providing service to patrons. Frequently requested data sets are now posted and accessible by anyone with Internet capabilities. E-mail is now commonly used for transmitting files, messages and data responses. Large data sets are regularly transferred using FTP (file transfer protocol). All of these capabilities mean faster, more efficient service for requesters, particularly those in remote locations.

Database growth was substantial. Range, technical description, diagnostic characteristics and habitat information was completed for approximately 200 plant species, and 1,400 additional literature sources were abstracted and entered. Approximately 48,000 records on bird observations were assimilated and used for the production of the *Fifth Edition, P. D. Skaar's Montana Bird Distribution*. Data base structures and procedures were developed to process large amounts of species observation data; currently we have catalogued approximately 11,000 observation records of amphibians, reptiles, birds and mammals.

Zoology: Research, Monitoring, Inventory, and Technical Information Service on Animals

Results from eight 1995 animal studies have been written up in reports. Highlights of 12 zoology field projects and other work in 1996 include the following:

Lick Creek Cave and surrounding areas of the Little Rocky Mountains were surveyed for bats by staff from the Heritage Program and BLM during a 4 day intensive field trip. Bats were surveyed using new electronic recording devices on the Beaverhead National Forest and Bureau of Land Management, Garnet Resource Area. Additional surveys were carried out in conjunction with the Department of State Lands, Abandoned Mine Bureau.

Surveys for Northern Bog Lemmings were completed along the Rocky Mountain Front for a collaborative project between the Heritage Program, Department of Fish, Wildlife and Parks, Lewis and Clark National Forest, and BLM.

Harlequin ducks were surveyed and monitored in the Kootenai, Blackfoot, Flathead and Clark Fork drainages with mixed results; reproduction ranged from poor to excellent in drainages examined. A conservation assessment and management plan for the northern rocky mountains was completed in conjunction with the Forest Service, Idaho Fish and Game, and biologists from Idaho and Wyoming.

A survey of lakes and reservoirs greater than 40 acres on the Lewistown District of BLM was completed for colonial nesting water and shorebirds. Several new Black Tern, Common Tern, Forster's Tern, and Black-crowned Night-Heron colonies were found, but fewer than had been expected.

Bird banding included White Pelicans at Arod Lake and Canyon Ferry Wildlife Management Area colonies and Harlequin Ducks in the Flathead and Clark Fork drainages. Over 25 Harlequins marked in Montana were relocated by the Canadian Wildlife Service on their wintering range on the Pacific Coast of British Columbia. Fewer birds were located along the coast of Washington and Oregon. Pelican bands have been recovered from several states, Mexico and as far away as Honduras.

Amphibians and reptiles were surveyed on the Lewis and Clark National Forest; several Department of Fish, Wildlife and Parks Wildlife Management Areas; Great Falls, Headwaters, and Dillon Resource Areas of BLM; most National Wildlife Refuges; and many USFWS Waterfowl Production Areas in north-central Montana. Results indicate Leopard Frogs have undergone a dramatic decline in western Montana in the past 30 years and are currently declining in much of eastern Montana as well. Western Toads also seem to be declining. We held 2 workshops on identification of Montana's reptiles and amphibians for the Montana Chapter of The Wildlife Society and Forest Service/BLM biologists.

We continued our work with the Partners in Flight Steering Committee, the Harlequin Duck Working Group, the Montana Piping Plover Working Group, the Montana Bird Distribution Steering Committee, the Western States Bat Working Group, the Arctic Grayling Workgroup, the Baird's Sparrow Working Group, and the Montana Prairie Dog Working Group. These efforts contribute to better coordination of research and management of these species as well as provide more effective means of agency collaboration and data sharing. The Heritage Program has played a key role in providing technical support and data management capabilities for many of these efforts.

The Montana Animals Species of Special Concern list was updated in April 1996. Copies are posted electronically on the Internet via the Heritage Program's WWW Home Page (<http://nris.mt.gov/mtnhp/nhp-dir.html>) and are available in print copy.

Botany: Research, Monitoring, Inventory, and Technical Information Service on Rare Plants

Results from twelve 1995 botany studies have been written up in reports. Select highlights of the twelve 1996 studies are presented below.

Survey was conducted for Ute ladies' tresses, a federally-threatened species, documenting new populations in two southwestern counties. Demographic monitoring was also established.

A draft range wide recovery plan was submitted for water howellia, a threatened species, and research was initiated to model the hydrology and ecology of its habitat.

Baseline botanical survey was completed at Alkali Lake on the Blackfeet Reservation, documenting a rare plant previously known only from southwest Montana and a rare community previously known only from south-central Montana. It will also provide wetland information and a landscape perspective for Piping Plover management. Baseline botanical surveys were conducted in three areas of BLM-administered land (Ruby Mts., a segment of the Missouri R., and Carter Co.)

Botanical reconnaissance and initial survey was conducted in the Tongue River vicinity to develop a target list and survey framework for future systematic surveys where background information is wanting.

A note on 19 new additions to the state flora was submitted for publication. At least two more new discoveries were made in the course of 1996 field projects.

The Montana Plant Species of Special Concern list was updated in 1996. It included moss species for the first time. Copies are posted electronically on the Internet via the Heritage Program's Home Page (<http://nris.mt.gov/intnhp/nhp-dir.html>).

Community Ecology: *Research, Inventory, Monitoring of Plant Communities*

Our participation with the Columbia River Basin large scale assessment has come to a close; as a result of our participation we were able to acquire considerable hardware and very valuable experience in landscape evaluation and data acquisition procedures. Assistant Ecologist, Tim McGarvey, who performed the difficult task of acquiring and converting data from all sources for the CRB project, is now engaged in upgrading and implementing ECADS, a database and analysis package. Though this is a US Forest Service product it should prove extremely useful to Heritage programs and others interested in analyzing ecological data sets; this system now incorporates soils variables and will soon have the capacity to perform analyses in a GIS environment

Much of the programming for ECADS has been performed by our quantitative Ecologist, John Caratti. In addition John has assisted US Forest Service personnel in complex multi variate analyses of watersheds and produced classifications of these same data. John has also assisted numerous individuals in outlining their research strategies and analysis routines and assisted with the interpretation of data. We anticipate John's assistance in analyzing various population data bases that have accumulated over the years

Ecologist Steve Cooper continues to participate as a beta-tester for the ECADS project; several manuscripts, including the classifications of southwestern and northeastern Montana, were prepared with the analysis and production capabilities of this software system.

Field work continues in the Centennial Valley with both the sampling and mapping of the Red Rock Lakes National Wildlife Refuge and the acquiring of background information necessary to understanding the historical vegetation of Beaverhead County and adjacent areas. The manuscript describing plant succession on the Sandhills of the Centennial Valley has been completed and brought favorable comments from land management agency staff regarding its application possibilities.

Several weeks in mid-winter were spent in a massive effort to crosswalk the vegetation classification of the Western Heritage Task Force among all states and updating the descriptions of types and their putative ranking. This classification is viewed as a prototype for a national vegetation classification that is just coming on line; Heritage programs nationwide will be invaluable resources for populating this classification.

Summer field work was concentrated on sampling/inventorying the aspen/black cottonwood grove land of the Blackfeet Indian Reservation; this is a very valuable resource because of its

high degree of use by wildlife, including neotropical migrant birds, all manner of large ungulates and the grizzly bear (for which these groves are prime habitat). These groves appear to be replacing themselves very satisfactorily; such is not the case with many of the groves in the Yellowstone Ecosystem, particularly those of Yellowstone National Park. Reservation groves also encompass more habitat diversity, including the occupation of significant portions of wetland.

We continue our participation in the Great Plains Initiative as a source of information regarding the mid- and short-grass prairie types of central and eastern Montana. This remains a region of Montana that has been woefully under sampled, but with proposed cooperative efforts with the US Forest Service and Bureau of Land Management this information shortfall may soon be remedied.

Water Information System

During 1996, staff continued improving access to water data by increasing the number of Internet links to new and existing sources of water information. Also during this time, many of the data sources established new products and report formats on the Internet. These new products make water information easier to obtain and interpret. Together with the Water Information System's efforts, these new products represent major strides that improve service to end users by making it easier to obtain information in ready-to-use formats. Many more users are taking advantage of the improved service, a fact demonstrated by the dramatic increase in the number of users obtaining water data directly via the Internet during the reporting period.

The Water Information System continues to use geographic information system (GIS) and new relational data base technologies increasingly to serve System users by developing tools for a variety of water related applications. This year staff assisted personnel from several other state agencies in obtaining and applying the GIS as an effective desktop tool for well head protection and management of solid waste landfill sites. Significant progress was also achieved in using new relational data base software to develop data bases with user interface menus that support traditional information management applications both within NRIS and other state natural resource agencies.

Information Requests

Internet access has had a major positive impact on the Water Information System's data delivery and clearinghouse service. A large number of users access the Water pages and over 6,000 downloaded information during the reporting period. These users essentially "serve themselves" without interacting with staff. This allows the staff to focus their time on serving users without Internet access and on more difficult requests and referrals. The web pages have also greatly improved the ability of the staff to refer users quickly to appropriate information sources within Montana, the U.S., and in some cases, in other parts of the world. Referrals are accommodated by an Internet Web page with dozens of active links to water data. This and other pages will be discussed in more detail under the Internet Access section.

Although the Internet has become an invaluable tool, the Water Information staff still take great pride in providing custom responses to a substantial number of information requests each year.

Custom service is available for patrons that do not have access to the Internet or the State's Bulletin Board, and for more complicated requests. The Water System will continue to place high priority on the personal and custom service for these patrons and for these types of requests.

About 563 individual custom requests were processed during 1996. This is slightly above last years number. Of the 563 non-Internet requests, approximately 38 percent came from state agencies, 35 percent were from the private sector, 14 percent were from the "other" category, primarily academic, local and county government. Federal agencies accounted for 13 percent of the requests. Among state agencies, DNRC and DEQ account for 21 and 20 percent of the requests, respectively. These agencies are followed by FWP, NRIS, and DOT.

Approximately 10,000 individuals visited the Water Internet pages during the reporting period. Of that number, 6000 remained long enough to download information from one or more of the pages. Most of the users appear to be from Montana and accessing the Water pages through independent Internet providers. Statistics indicate that about 30 percent of the users are private individuals, 30 percent are from the education sector, and about 12 to 15 percent are associated with a federal, state, or local governmental agency. The Internet usage has greatly enhanced the Water Information System's ability to serve users.

Program Outreach

Staff provided numerous groups with presentations and seminars on the NRIS program, Water Information services, GIS technology, and data base management software and techniques. Presentations were given to the county planners, local citizen water resource organizations, conservation districts, citizens involved with volunteer water monitoring, grade schools and institutions of higher education. Many of these groups now request presentations and workshops annually. Staff have also been requested to advise several groups planning data collection and dissemination activities. Groups like the Upper Clark Fork Steering Committee, Bitterroot Watershed Council, Big Hole Basin Watershed Committee, and others requested input and feedback from the Water Information Coordinator periodically throughout the year.

Several previous outreach efforts came to fruition during the reporting period. For several years Water System staff promoted the use of GIS technology for water resource applications among state agencies and watershed committees. This year the Department of Environmental Quality initiated the use of GIS in two areas, well head protection and management of landfills. In both cases, Water Information staff worked closely with the DEQ personnel to provide base-level data, training and technical support. DEQ staff are now using desktop GIS software to assist in developing maps of local well head protection areas and conduct simple spatial analysis. DEQ staff, with assistance from Water System staff, integrated landfill site locations and attribute information into GIS format. For the first time, Montana has a GIS coverage depicting landfill locations and indicating whether they are active or closed. This is an important GIS layer because it can be combined with other GIS layers showing the locations of shallow ground-water resources and analyzed to help identify shallow aquifer throughout Montana that may be at risk to contamination plumes beneath landfills. In addition to the DEQ, the Upper Clark Fork Steering Committee requested assistance in using GIS to help prioritize management decisions and identify water use trouble-spots within their basin. NRIS will provide some programming services to generate standard data sets and maps of the basin and will transfer the GIS to the DNRC Water Rights Field Office in Missoula. DNRC staff will continue supporting the Committees use of GIS with assistance from Water Information staff. The Water Information

System will continue to work with the DEQ, other state agencies, and citizen groups to help them use GIS as a tool for water resource management.

Water Related Coordination Committees

Advising committees on water information policy continued to be an important activity for the period. Throughout the year the Water Information Coordinator provided updates to the following committees: Environmental Quality Council (EQC) which now includes the Legislative Water Policy Committee; Water Resources Coordination Committee; Big Hole Watershed Advisory Committee; and others. The Coordinator continues to chair the Ground Water Assessment Steering Committee. The committees also provide opportunity for the Water Coordinator to track statewide operations of other state and federal agencies, and to keep apprised of existing laws and policies that effect water resources.

Internet Access

Major effort has been directed in maximizing the use of the Internet for improving access to water information. This effort resulted in construction of a series of Water Information Web pages accessible from the main NRIS Web page. From the main water page a user can:

1. See descriptions of all sources available through the Water Information System;
2. Directly access water data and map products from a variety of sources;
3. Access current and historic drought monitoring information including Surface Water Supply Index (SWSI) maps and histograms, Palmer Drought Severity Index (PDSI) maps and histograms, and Relative and Visual Greenness satellite imagery;
4. View maps and reports from the Montana Rivers Information System; and
5. Examine a presentation on applying GIS technology to water resource applications.

The "Active links" page provides a way to quickly link users with useful and timely water information. For example, several sources deliver near real-time information on snow pack, reservoir storage, and streamflow discharge. Prior to this year, this type of information was very difficult to access and nearly impossible to download locally. Other sources provide daily and monthly updates which are also useful. All of this information is available in ready-to-use graphic and map format. The map products make it possible to quickly assess snow pack, streamflow, reservoir storage and soil moisture conditions on a statewide and regional basis. It is important to note also that users can download these products to their home or office computer for use in reports and presentations.

The Drought Monitoring page also provides users with maps, graphs, and text files that help quickly assess moisture conditions on a statewide basis. During the period from February to August, Drought Monitoring products are updated monthly and widely used. The maps and graphics can be downloaded and used for a variety of purposes.

Projects Overview

Montana Rivers Information System (MRIS): MRIS data continues to be requested frequently and general information about MRIS is also accessed frequently from the Water Information's MRIS Web page. The data base continues to be one of the primary sources of river-related information for Montana. To make it easier for users to access the MRIS, staff from the Water

System and Montana State Library (MSL) installed a copy of the data base on a computer network server at the MSL. Remote users are now able to access the MRIS via the State's SUMMITNET computer network. This arrangement has several advantages. First, users do not have to install the MRIS software and data base on their local hard drive which requires about 40 megabytes (MB) of disk space. Another advantage in this arrangement is that it greatly simplifies software and data maintenance because staff only need to update the one network copy of MRIS rather than 30 to 50 individual copies installed through Montana. In addition, trouble shooting software installation is eliminated. The Water Information System and MSL will continue to provide access to MRIS in this manner on a trial basis for the coming fiscal year.

Plans have been made to test remote use of the MRIS on the Internet. Implementation and testing of Internet access will take place sometime next fiscal year. This arrangement will expand access to patrons that do not have access to the SUMMITNET.

Montana Drought Monitoring: As stated above, Drought Monitoring products continue to be valuable tools for a variety of users and are accessed frequently. Products provided during the reporting period included the SWSI maps, histograms, and special histograms comparing the current month's SWSI with the previous month's values. Visual and Relative Greenness maps, developed from satellite imagery, were provided on a weekly basis beginning in May of the reporting period. Missing from the list of products are Palmer Drought Severity Index (PDSI) maps and histograms. Access to the PDSI data ended when Montana State University (MSU) closed its Climate Center.

Steps were taken during the year to encourage MSU to reopen the Climate Center but no funding source could be found. The Water Information Coordinator with assistance from DNRC staff member Jesse Abers, initiated communication with Dr. Kelly Redmond in an attempt to obtain either PDSI data or an alternative index data from the Desert Research Institute (DRI). Dr. Redmond agreed to help with Montana's Drought Monitoring effort and steps will be taken to write a grant to help NRIS, DNRC, and the DRI replace the PDSI data set. The Water Information System remains committed to expanding the use of drought and climate information and will continue to use the Internet, State BBS and the news media to keep citizens informed.

Montana Climate Information Center at NRIS: Closure of the MCC is a serious set-back for the Drought Monitoring Program. It was also a serious setback for many programs that depend on timely reporting of climate information, and for new efforts to expand the use of climate information to help citizens and government respond to, and in some cases take advantage of, Montana's diverse climate and variable weather conditions. To address this need, the Water Information Coordinator discussed options with MSU, DNRC, National Weather Service (NWS), and others to identify the role NRIS's Water Information System can play in filling the information gap. After these discussions, the Water Coordinator wrote a grant proposal to the Montana Renewable Resource Grant Program. The primary objective of the grant proposal would be to establish a Climate Information Center as part of the NRIS program to supply, and expand on, services provided by the former Climate Center. NRIS would not conduct research but would use startup funding to help defray the expense of establishing the Climate Information Center. NRIS would work with the Western Regional Climate Center in Reno, Nevada, and others, to make existing weather and climate information available to anyone who needs it. Under this proposal, the Water System would maintain data summaries and develop tools to support applications used in agriculture, recreation, water- and land-use management, engineering projects, mining, and environmental impact assessment. New geographic information system (GIS) maps and graphs would be developed to make the climate information

easier to understand. All data products would be available through NRIS (customized request responses, over the Internet, from the State BBS).

Montana Ground Water Atlas: Shortage of funding for publication delayed the release of the Atlas. The Water Information Coordinator, and staff from the Montana Department of Environmental Quality (DEQ) and EPA Region VIII have been working to identify additional sources of funding. EPA is committed to providing additional funding during the next fiscal year. In the mean time, the Water Information Coordinator is developing an electronic version of the Atlas to be distributed via the Internet. The electronic version of the Atlas will include text, figures, and high quality maps and can be viewed with free software. The electronic version of the Atlas will be a useful addition to the hard copy publication and should be valuable to resource managers, educators, and private citizens.

Volunteer Water Monitoring: During the last days of the fiscal year, a contract was signed between NRIS and the DEQ. Several changes were implemented in the projects as specified in the contract. Because the DEQ did not receive an FTE for the projects coordinator position, the Water Information System was given the lead in coordinating the Volunteer Water Monitoring project. A subcontract will be developed for the coordinator position with the Montana Watercourse at MSU. Watercourse will coordinate both the citizen and education volunteer monitoring programs. The Coordinator will work with an advisory committee to set specific goals and guidelines for the statewide coordination of volunteer monitoring. The Position will also develop training materials and provide technical assistants and training seminars. The Water Information System's role in volunteer water monitoring will be to provide data management tools and training for volunteer groups statewide. There are several optional approaches to providing these tools. Software could be developed by Water Information staff for distribution to individual groups. Another option is to focus development of tools for access and distribution via the Internet. Base map information will also be structured and organized for more efficient use by citizen volunteer monitoring groups. The specific approach use by the Water Information program will be set next fiscal year after meeting with the projects advisory group.

DEQ Waterbody - EPA RRN Project: The Waterbody data base is maintained by the DEQ and documents impaired stream reaches and identifies the cause and source of impairments. A short coming of the Waterbody data base is that individual stream reaches cannot be displayed or mapped in an automated way. The goal of this project is to link individual reaches within the Waterbody data base with the EPA River Reach Numbering system. These numbers allow stream reach information to be integrated into a geographic information system (GIS). The project is basically a pilot project to develop and refine procedures for linking Waterbody to stream reach segments indexed with EPA's RRN system. The Pilot would be conducted for Hydrologic Unit 10070002 (Yellowstone River near Livingston). Specific goals will be: 1) Establish a methodology to assign RRN's to Waterbody reaches; 2) Automate the process; 3) Complete indexing for the pilot area; and 4) Estimate the number of watersheds that could be completed with the automated procedure. Adding EPA reach numbers to the Waterbody data base represents a significant step forward in making it possible to use water quality data from multiple sources to evaluate the status of a stream reach. Once complete, individual stream reaches can be assessed using a GIS and data from the DEQ Waterbody data base, the FWP MRIS, and EPA's STORET.

